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(54) **Furnace muffles.**

(57) A furnace muffle (6) comprising a hollow ceramic fibrous support member (8), an open channel (9) defined in the inside surface of said support member (8), and a heating element (10) loosely disposed in said channel (9). The said heating element (10) is prevented from moving out of the said channel (9) by means of a glazed quartz cristal tube (11) of low thermal impedance material located in a facing relationship to the said inside surface of the support (8).

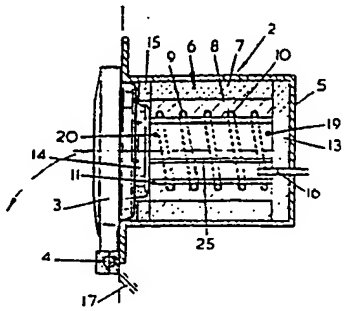

FIG 4

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FURNACE MUFFLES

The present invention relates to furnace muffles and to furnaces comprising such muffles.

A variety of furnace muffles are available which are designed for the firing of ceramic work-pieces such as are required, for example, for dental applications. Amongst these furnace muffles it is known to provide a furnace muffle comprising a coiled electric heating element held in place within the muffle in a channel by means of a plurality of strips of ceramic fibrous material cemented across the opening of the channel. Unfortunately this arrangement does not provide an even distribution of heat within the furnace muffle because the strips cemented across the top of the coiled electric heating element impede the radiation of heat therefrom.

An additional problem encountered with conventional furnaces is that they are accessible through a closure member located at the top of the furnace. Since it is a requirement of such furnaces for the door to open automatically, the positioning of the closure member at the top of the furnace means that means must be provided for pivoting the closure member about a horizontal or vertical axis to open and close the lid. Such means are quite complicated.

Further, where the closure member of the furnace is located at the top of the furnace it means that a user of the furnace must usually stand to see into the furnace and that access to objects within the furnace

is awkward due to heat rising from the interior of the furnace.

It is an object of the present invention to provide a furnace in which the above-mentioned problems are obviated or mitigated.

According to the present invention there is provided a furnace muffle comprising a hollow ceramic fibrous support member, an open channel defined in the inside surface of said support member, and a heating element loosely disposed in said channel, characterised in that the said heating element is prevented from moving out of the said channel by means of a member of low thermal impedance material located in a facing relationship to the said inside surface of the support.

Preferably the said member is tubular and is formed from glazed quartz crystal, and the support member is tubular with the open channel being helical.

Preferably a support on which a work-piece can be mounted in the furnace muffle is provided, the said support being comprised of glazed quartz crystal.

According to a second aspect of the present invention there is provided a furnace comprising a furnace muffle of the above type, the furnace further comprising a closure member adapted to close an opening in the furnace through which opening a

work-piece may be directly introduced into the muffle, and means for energising the heating element to heat the muffle, wherein the closure member and the opening to the muffle are arranged in the front of the furnace, the closure member being adapted to pivot about a horizontal axis to close the opening and being adapted to be normally open unless held closed.

Preferably the closure member comprises a thermally insulating body adapted to close the opening of the muffle.

Preferably the closure member is adapted to seal the muffle so as to enable evacuation of the muffle, by for example a vacuum pump.

The closure member pivot may be located beneath the opening to the muffle so as to extend parallel to the front face of the furnace, the centre of gravity of the closure member being located such that it falls open unless held closed. Alternatively, the pivot may extend perpendicular to the front face of the furnace.

Preferably the closure member is held closed by the pressure difference across it when it is closed and the vacuum pump is on.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which :-

Fig. 1 shows a dental furnace embodying the

present invention, in which the door to the furnace container is closed;

Fig. 2 shows the dental furnace of Fig. 1, in which the door to the furnace container is closed;

Fig. 3 shows an exploded view of the furnace container of the furnace of Fig. 1 with the door to the furnace container open; and

Fig. 4 shows a cross section through furnace container of Fig. 3 with the door shown in its closed position.

Referring to Figs. 1 and 2, the illustrated furnace comprises a casing 1, within which are mounted on the left hand side a furnace container 2 and on the right hand side of the casing control devices and indicators which it is considered are unnecessary to describe in detail.

The furnace container 2 is opened and closed by a door 3, which is pivotable about a horizontal axis provided by pivot 4. A shelf 25 is provided in the bottom of the interior of the furnace container 2 upon which work-pieces to be fired can be mounted. As can be seen from Figs. 1 and 2 access to the interior of the furnace container 2 is from the front of the furnace itself.

Referring now to Figs. 3 and 4, the furnace container and the door by which it is opened and closed will be described in detail.

The furnace container 2 comprises a cup shaped

vessel 5 which receives a cylindrical muffle 6. The muffle 6 comprises an outer cylinder 7 of ceramic fibrous material and an inner cylinder 8 of ceramic fibrous material, in the inner surface of which is defined a helically shaped channel 9. Located within the channel 9 is a coiled heating element 10 the ends of which are connected to conductors (not shown) which extend through the muffle wall and the cup shaped vessel 5. The heating element 10 is held in place in the helical channel 9 by means of a glazed quartz crystal tube 11, the outer diameter of which is slightly less than the inner diameter of the inner cylinder 8, enabling the tube 11 to be push fitted into the furnace container. As well as securing the heating element 10 in the helical channel 9 the crystal quartz tube 11 ensures an even distribution of heat from the heating element 10 into the interior of the furnace container 2 where a work-piece is placed. A crystal quartz plate 25 is mounted in the bottom of the crystal quartz cylinder 11 on which to mount a work-piece. The plate 25 holds the work-piece centrally within the interior of the furnace container 2 and because it is crystal quartz ensures that there is no uneven heat distribution between the top and bottom of it.

In order to thermally insulate the furnace interior completely a pad 13 of ceramic fibrous material is located at the inside end of the vessel

5 to close the muffle 6 at its inside end and the door 3 supports a thermally insulating body 14 of ceramic fibrous material which engages in the opening to the interior of the furnace. An O-ring 15 of ceramic fibrous material is located against the outside end of the muffle 6 so that when the door 3 is closed a thermal seal is formed between the O-ring 15 and the body 14 of the door 3. A silicon rubber O-ring (not shown) is also provided in the door 3 so that when it is closed an air-tight seal of the interior of the furnace is formed.

In order that the temperature within the interior of the furnace container 2 can be sensed a temperature sensing device 16 extends through the pad 13.

A door 3 is pivotably connected to the casing 1 below the entrance to the furnace interior. The door is pivotable about a horizontal axis provided by pivot 4 and its centre of gravity is such that the door 3 always opens unless held in its closed position.

The pivot 4 is connected to an arm 17 which operates a switch (not shown) through a slot 18 in the casing 1. When the door 3 is closed arm 17 moves in slot 18 and actuates the switch which turns on a vacuum pump (not shown) which is connected to the interior of the furnace container 2, through outlet 19, and energises the heating element 10.

Air is bled into the furnace interior through a solenoid controlled bleed valve (not shown) via inlet 20. The resulting pressure differential across the door 3 is sufficient to maintain the door 3 closed.

The air bled in via inlet 20 passes diametrically across the container, scavenging gassed off vapours in the process. When the temperature in the furnace reaches a first predetermined temperature the solenoid controlled bleed valve is shut to give a full vacuum. When a second predetermined temperature is reached the bleed valve is reopened to release the vacuum and the pump is stopped. Thus air is bled into the container via inlet 17. The pressure differential across the door 3 falls and because of the weight of the door 3 it drops open.

It will be appreciated that the furnace muffle and the furnace of the present invention provides a number of advantages over the prior art.

The crystal quartz tube provided in the interior of the furnace muffle ensures a clean firing chamber by keeping metallic oxides from the heating coil away from the workpiece.

In addition, because the temperature of the furnace and the workpiece remain the same throughout the firing process there is never any thermal shock to the workpiece.

Further because insitue cooling of the work-

piece is possible the outer skin of the workpiece remains at the same temperature as the body of the workpiece thus ensuring no thermal stress between the two which could result in crazing of the surface.

In the described embodiment of the invention the door 3 swings open about a horizontal pivot running parallel to the front face of the furnace. After use, the inner surface of the door is hot and this can cause discomfort to a person using the furnace. This problem can be overcome by providing an alternative door support mechanism which results in the door swinging away from the entrance to the furnace interior about a horizontal pivot perpendicular to the front face of the furnace. For example the door could be supported on a short arm pivoted on a shaft extending from the front to the back of the furnace casing, the shaft being positioned above and to one side of the centre of the furnace entrace. The door can be spring loaded so that when released it moves forwards parallel to the shaft axis and then swings away from the furnace entrace as a result of pivoting about the shaft under the influence of gravity.

CLAIMS:

1. A furnace muffle comprising a hollow ceramic fibrous support member, an open channel defined in the inside surface of said support member, and a heating element loosely disposed in said channel, characterised in that the said heating element is prevented from moving out of the said channel by means of a member of low thermal impedance material located in a facing relationship to the said inside surface of the support.

2. A furnace muffle according to claim 1, wherein the said member is of glazed crystal quartz.

3. A furnace muffle according to claim 1 or 2, wherein the support member is tubular, the open channel is helical and extends from adjacent one end of the tubular support member towards the other, and the said member is tubular.

4. A furnace muffle according to claim 1, 2 or 3, comprising a support on which a work-piece can be mounted in the furnace muffle, the said support being of glazed crystal quartz.

5. A furnace comprising a furnace muffle according to any preceding claim, further comprising a closure member adapted to close an opening in the furnace through which opening a work-piece may be directly introduced into the muffle, and means for energising the heating element to heat the muffle, wherein the closure member and the opening to the

muffle are arranged in the front of the furnace, the closure member being adapted to pivot about a horizontal axis to close the opening and being adapted to be normally open unless held closed.

6. A furnace according to claim 5, wherein the closure member comprises a thermally insulating body adapted to close the opening of the muffle.

7. A furnace according to claim 5 or 6, wherein the closure member is adapted to seal the muffle so as to enable its evacuation.

8. A furnace according to claim 7, wherein the closure member is held closed by the pressure difference across it when it is closed and the muffle is evacuated.

9. A furnace according to claim 7 or 8, wherein a silicon rubber O-ring is supported by the closure member to provide an air-tight seal.

10. A furnace according to any one of claims 5 to 9, wherein the pivot of the closure member extends parallel to the front of the furnace and is located beneath the opening to the muffle, the centre of gravity of the closure member being located such that the closure member falls open unless held closed.

11. A furnace according to any one of claims 5 to 9, wherein the pivot of the closure member extends perpendicular to the front of the furnace, the centre of gravity of the closure member being

located such that the closure member falls open unless held closed.

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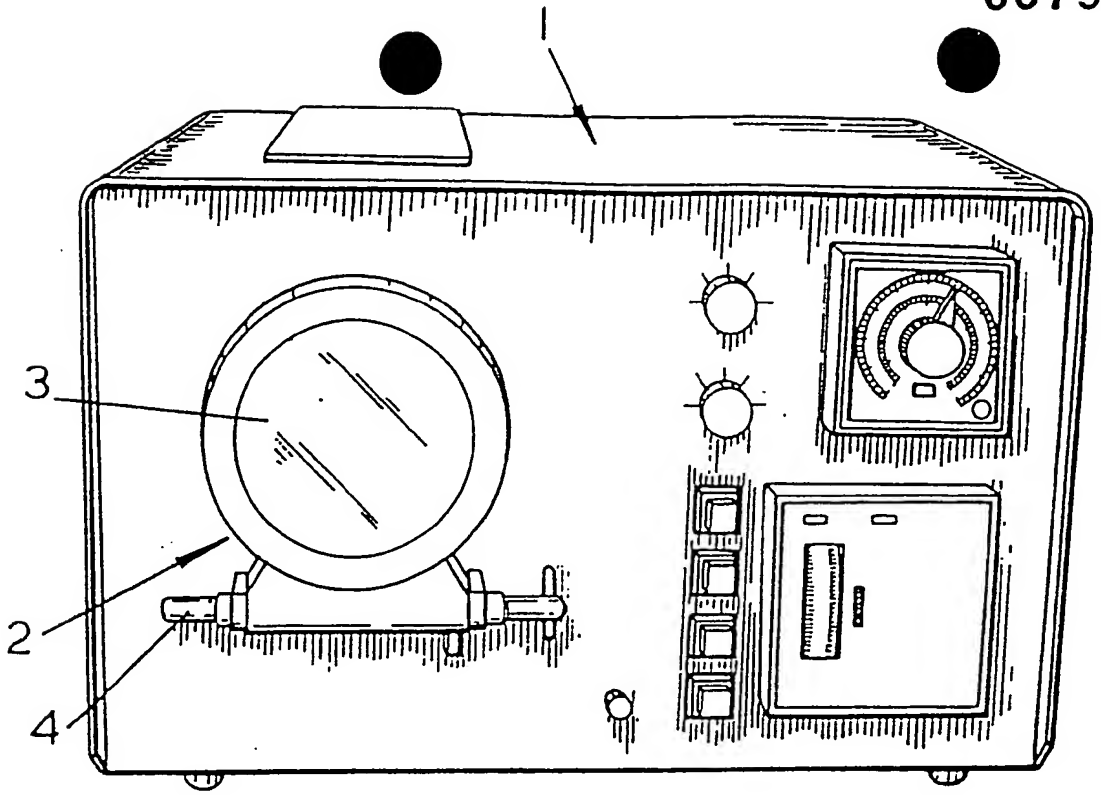

FIG. 1

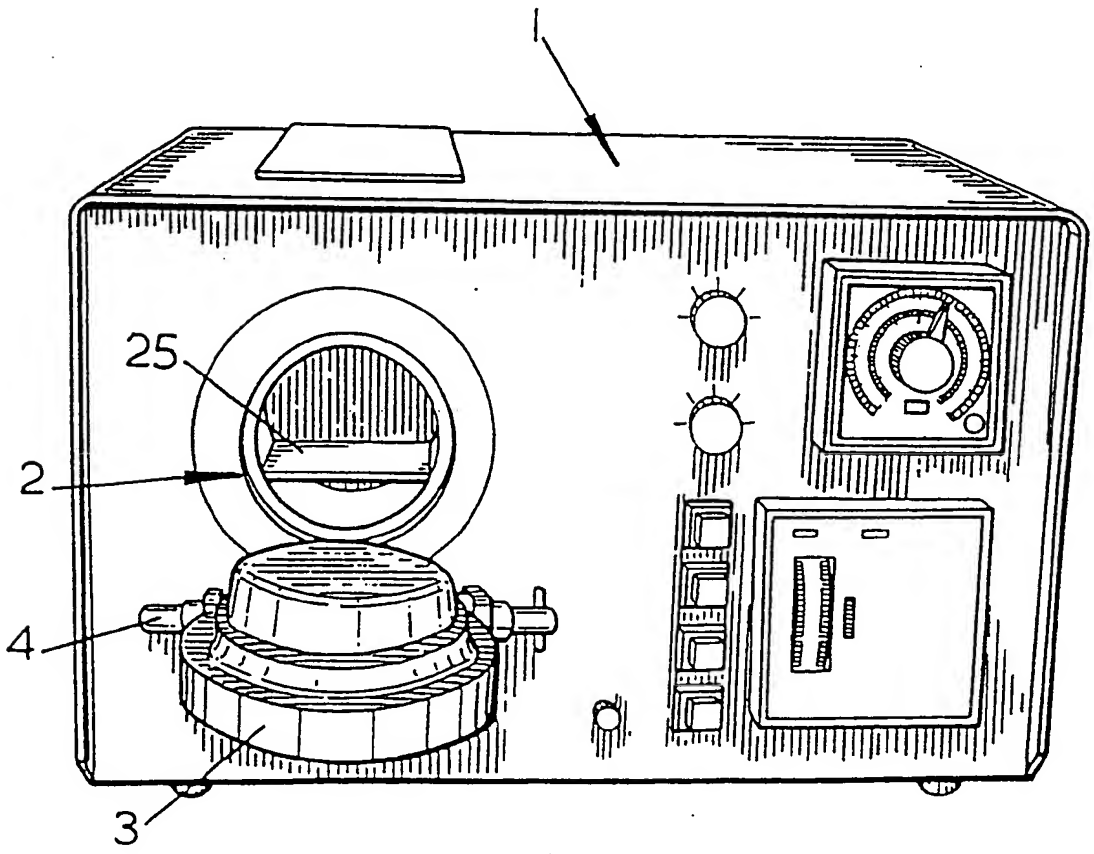

FIG. 2

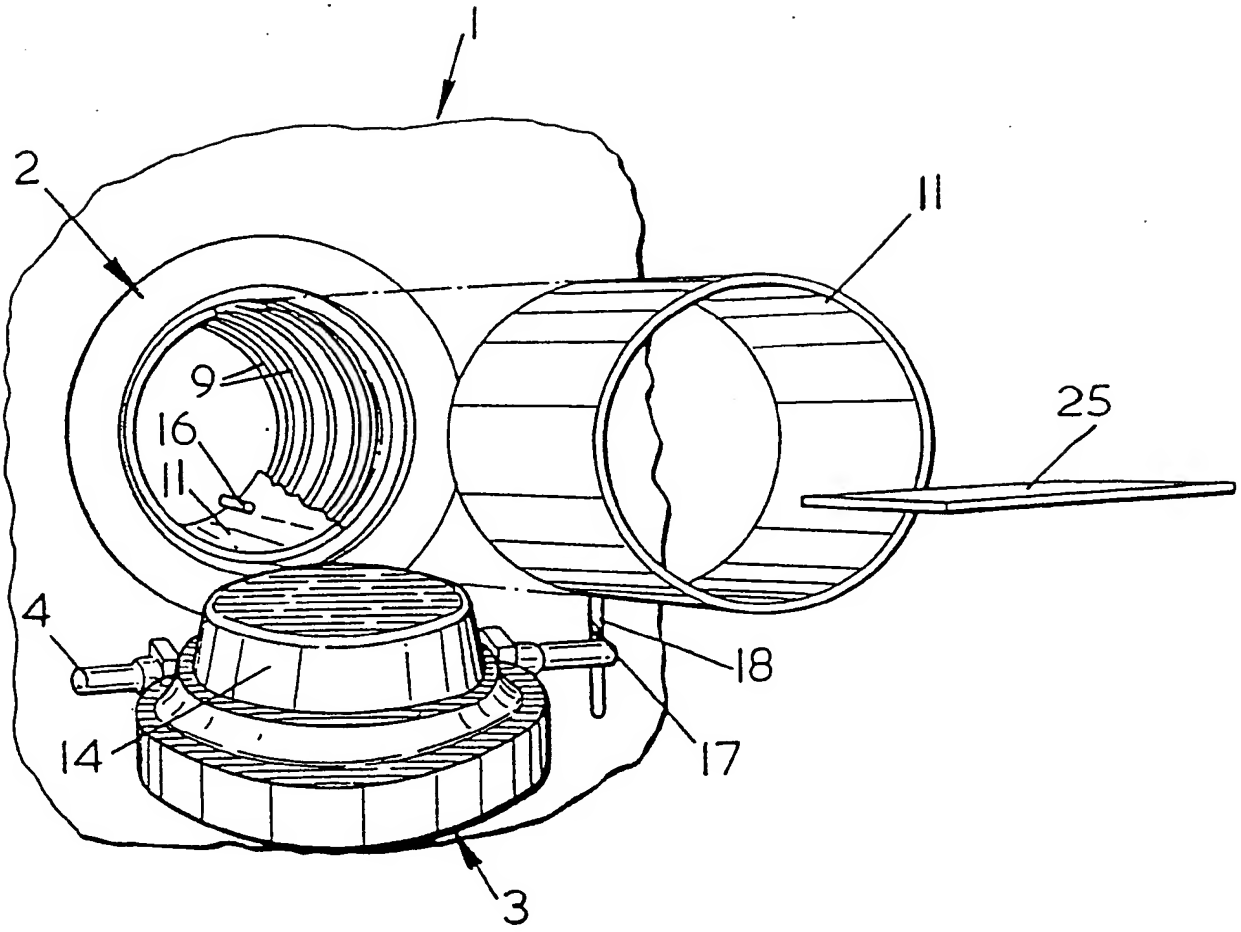

FIG. 3

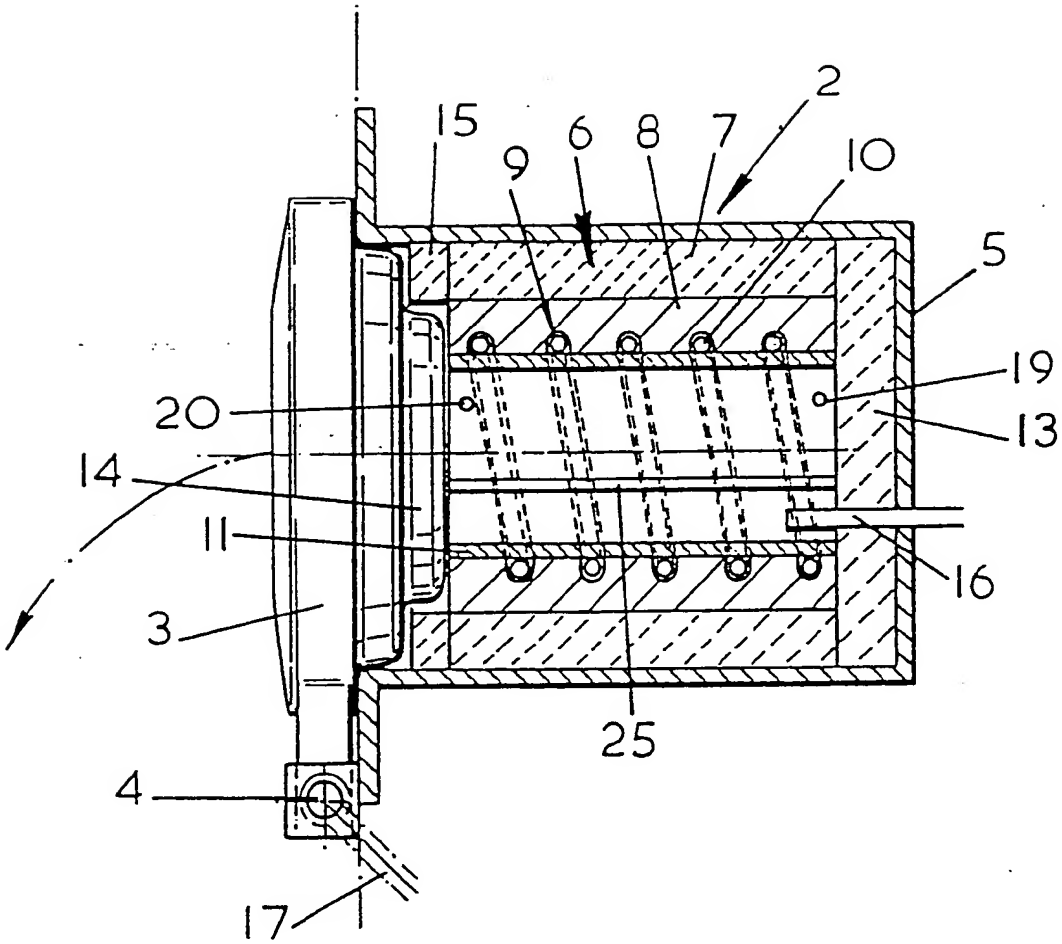

FIG. 4

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EUROPEAN SEARCH REPORT

0079730
Application number
EP 82 30 5883

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-4 272 670 (DOCX) *Figures 1,2,8; abstract; claims; columns 4,6*	1,3-11	F 27 B 5/04 F 27 B 17/02 F 27 D 11/02 H 05 B 3/66
Y	US-A-3 406 242 (KARL A.LANG) *The whole document*	1,2	
Y	US-A-3 972 682 (STEPHENS et al.) *Abstract; claims*	1,2	
Y	GB-A-1 441 577 (DOCX) *Figures; claims*	1,2	
A	AU-B- 20 691 (ZAHNFABRIK WIENAND)(1967)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	FR-A-1 390 876 (BRAGLIA)		F 27 B F 27 D H 05 B
A	DE-B-1 294 600 (INSTITUT FÜR ZIEGELFORSCHUNG)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-02-1983	OBERWALLENEY R.P.L.I

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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